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CONFIDENTIAL

TWENTY-SECOND

PROGRESS REPORT

OF

THE FIRESTONE TIRE & RUBBER CO.

ON

105 MM BATTALION ANTI-TANK PROJECT

Contract No.
DA-33-019-ORD-33 (Negotiated)
RAD ORDTS 1-12383

THE FIRESTONE TIRE & RUBBER CO.
Defense Research Division
Akron, Ohio

MAY, 1952

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ABSTRACT

On May 19, 1952, The Firestone Tire and Rubber Company, Defense Research Division, participated in a BAT weapon demonstration held at Aberdeen Proving Ground. The activities of this group in the demonstration are reported. Photographs of the Firestone weapon, the firing crew, and the ammunition are presented.

The weapon assemblies completed to this time are accounted for and the test status explained. A proposed reversed flow propellant-shell case system is illustrated and discussed.

The data assembled in the firing of seventy-six rounds of T-138 E57 ammunition to test fuze functioning is presented. The tests show a very definite influence of the tee cap on fuze functioning.

There were no firings with the T-171 projectile during the month of May.

The T-119 projectile was fired as a part of the BAT weapon demonstration and the data are given.

Two series were fired in the penetration studies. The tests were made to compare target materials and to study the effect of length and diameter of spitback tubes on penetration. The firing data are given.

The activities in the study of fuzes are presented and discussed. A proposed wiring modification and a suggested nose element design are illustrated.

BAT WEAPON DEMONSTRATION
Aberdeen Proving Ground, May 19, 1952

The Firestone Tire and Rubber Company, Defense Research Division, was invited by Office, Chief of Ordnance to participate in a BAT weapon demonstration to be held at Aberdeen Proving Ground on May 19, 1952.

The demonstration featured the following weapon assemblies and ammunition: (1) the M-27 recoilless rifle (jeep mounted) firing T-184 and M-324 ammunition; (2) the T-135 recoilless rifle (jeep mounted); (3) the T-136 recoilless rifle (jeep and ground mounted firing T-118 ammunition; (4) the six-gun ONTOS mount and (5) the T-137 recoilless rifle (jeep and ground mounted) firing T-138 and T-119 ammunition. Certain of the weapon assemblies and ammunition were used in a demonstration of accuracy and penetration.

Three Firestone weapon assemblies each consisting of a T-137 E1 rifle, T-152 E2 mount, T-46 spotting rifle and M-62 E4 elbow sight; and two types of ammunition, T-138 E57 and T-119, were prepared for the demonstration. Figures 1, 2, 3 and 4 are four views of the weapon assembly mounted on an M38 truck. Figures 5 and 6 show the projectile assemblies.

The .50 caliber spotting rifle ammunition used in these tests had a velocity designed for matching the Frankford Arsenal T-118 projectile. The spotting rifles were therefore "biased in" so that the centers of impact for the .50 caliber and T-138 ammunition were coincident at approximately 950 yards. The velocity of the T-119 was then adjusted to match both the spotting bullet and the T-138 at 950 yards.

The bias required for the .50 caliber rifle was - 2 1/2 mils elevation and +2 mils azimuth at approximately 950 yards.

One mil right bias was required on the sight, M62 to cause the optical axis and the center of impact for the T-138 projectile to be coincident.

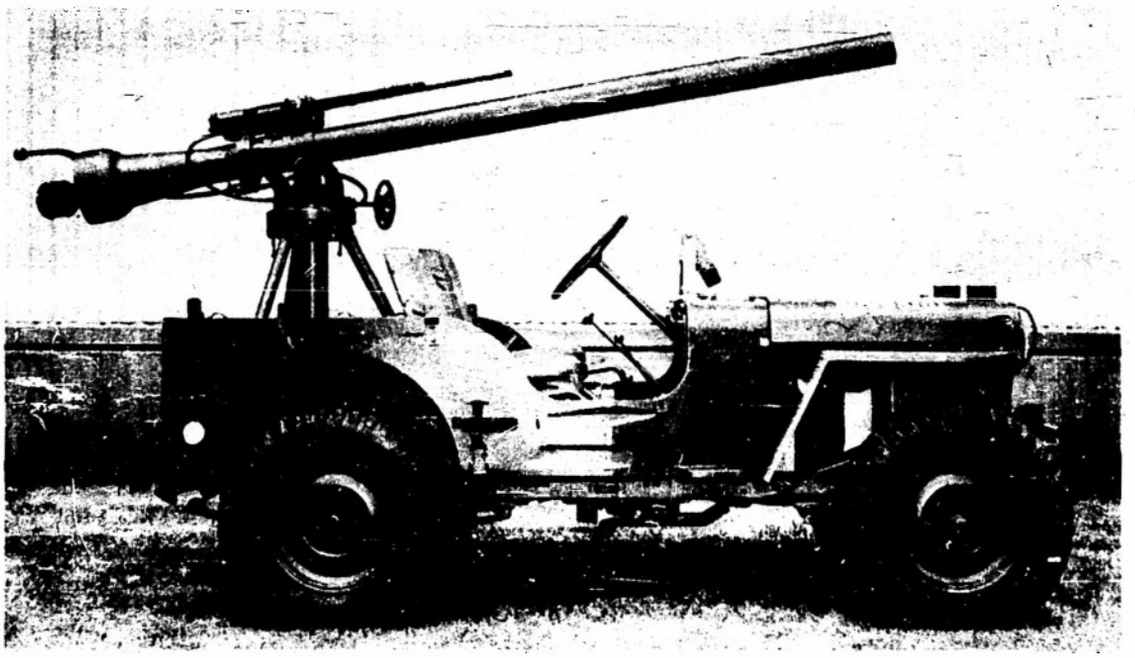

Fig. 1. Weapon Assembly on M-38 Truck.
T-137 E1 Rifle, T-152 E2 Mount, T-46 Spotting Rifle, M62 E4 Elbow Telescope.
Breech open, major caliber slightly elevated.

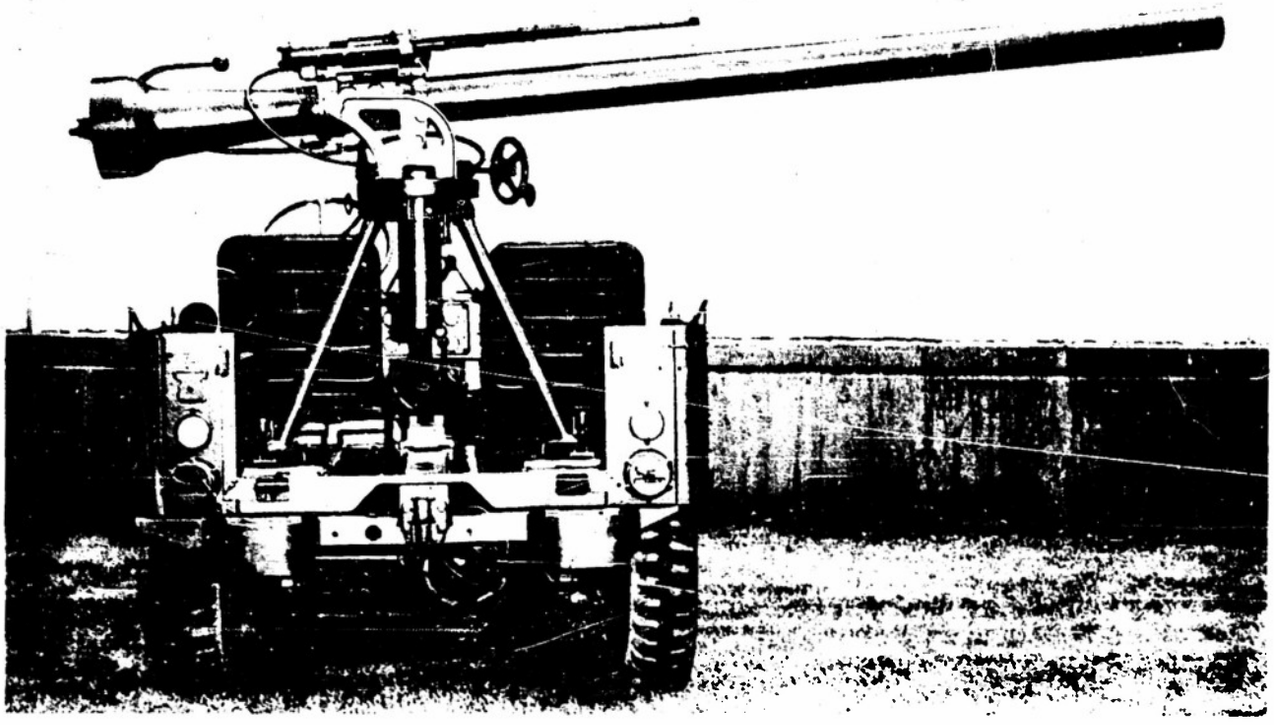

Fig. 2. Weapon Assembly on M-38 Truck.
Component Parts Same as Given in Fig. 1.
Rotated 90 degrees from normal travel position.

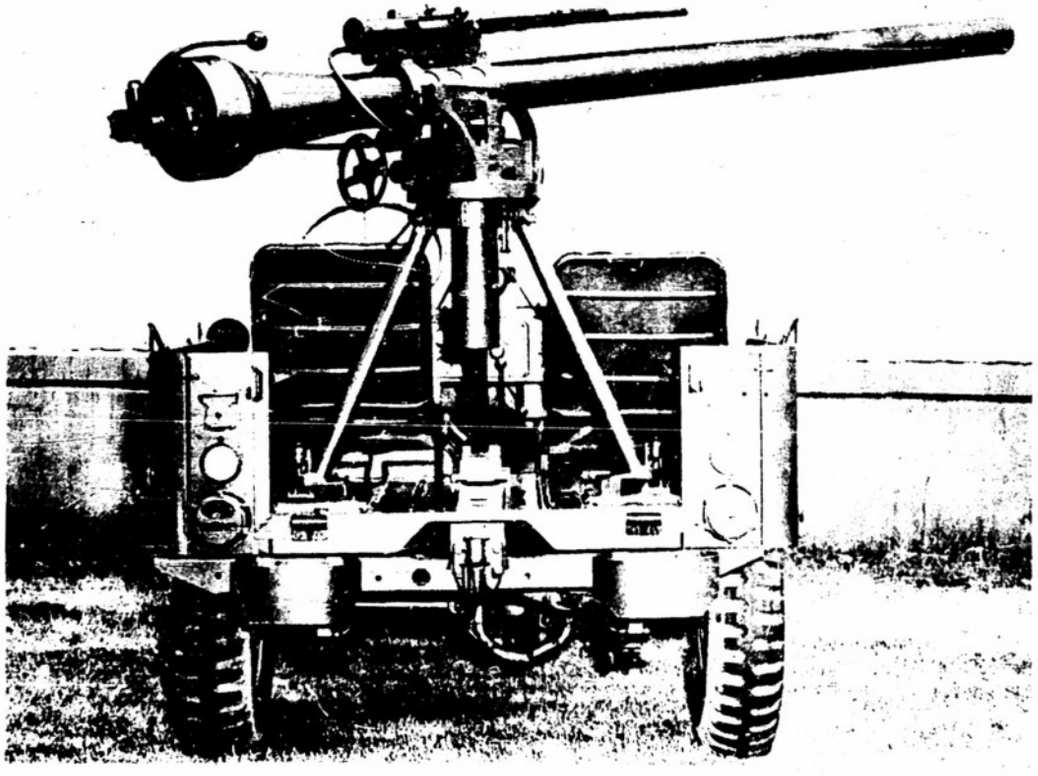

Fig. 3. Weapon Assembly on M-38 Truck.
Component Parts Same as Given in Fig. 1.
Elevated and rotated from normal.

Fig. 4. Weapon Assembly on M-38 Truck.
Component Parts Same as Given in Fig. 1.
Rotated 90 degrees left. Note toggle clamps.

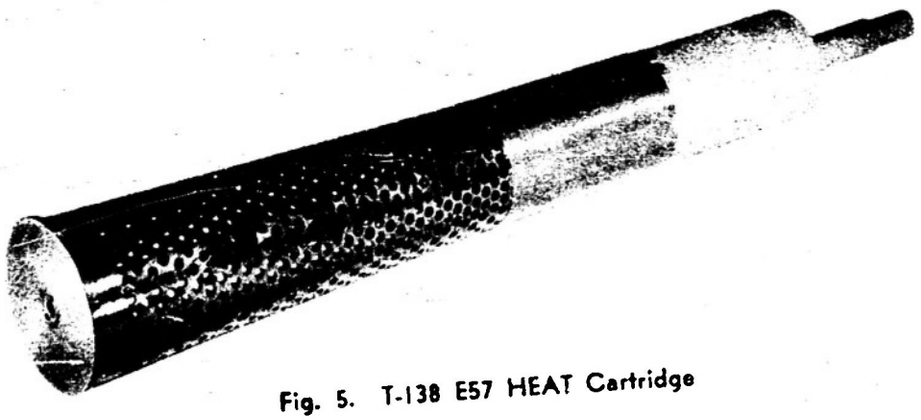

Fig. 5. T-138 E57 HEAT Cartridge

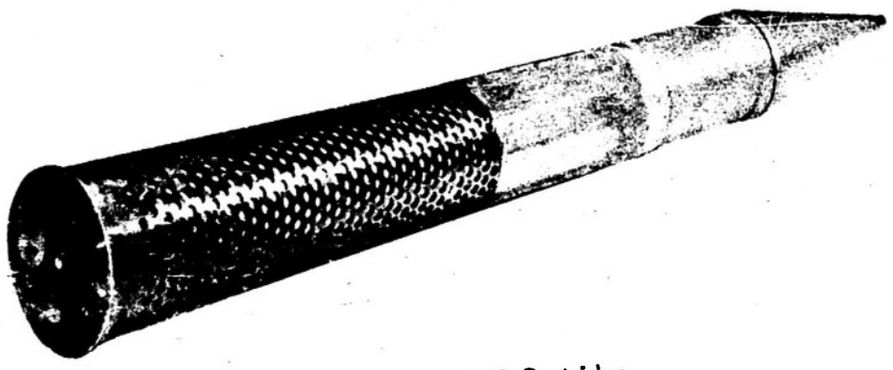

Fig. 6. T-119 HEAT Cartridge

Handling of the Weapon

Although the normal crew for the 105 mm BAT weapon is expected to be five men, it was found, during preparations for the demonstration, that the T-137 rifle and T-152 mount can be handled as a complete unit by a three-man crew. Figure 16 illustrates the weapon assembly and a three-man Firestone crew.

In one phase of the demonstration the three-man crew removed the weapon assembly from the M-38 truck and put it into firing position in 45 seconds. Figures 7, 8, and 9 show the steps in removal of the assembly from the truck. The gun and mount were disassembled into three pieces (chamber, tube and mount), carried approximately 30 feet and reassembled on the jeep in traveling position in 1 minute and 40 seconds. Figures 10, 11, 12, and 13 show steps in the disassembly and Figures 14, 15 and 16 illustrate the steps in reassembly.

Fig. 7. First Step in Removal from Truck.
Toggles Unclamped, Front Leg Removed from Clamp Block.

Fig. 8. Second Step in Removal from Truck.
Assembly Moved With One Leg Remaining On Bed.

Fig. 9. Third Step in Removal from Truck.
Assembly Lowered to Ground As Shown.

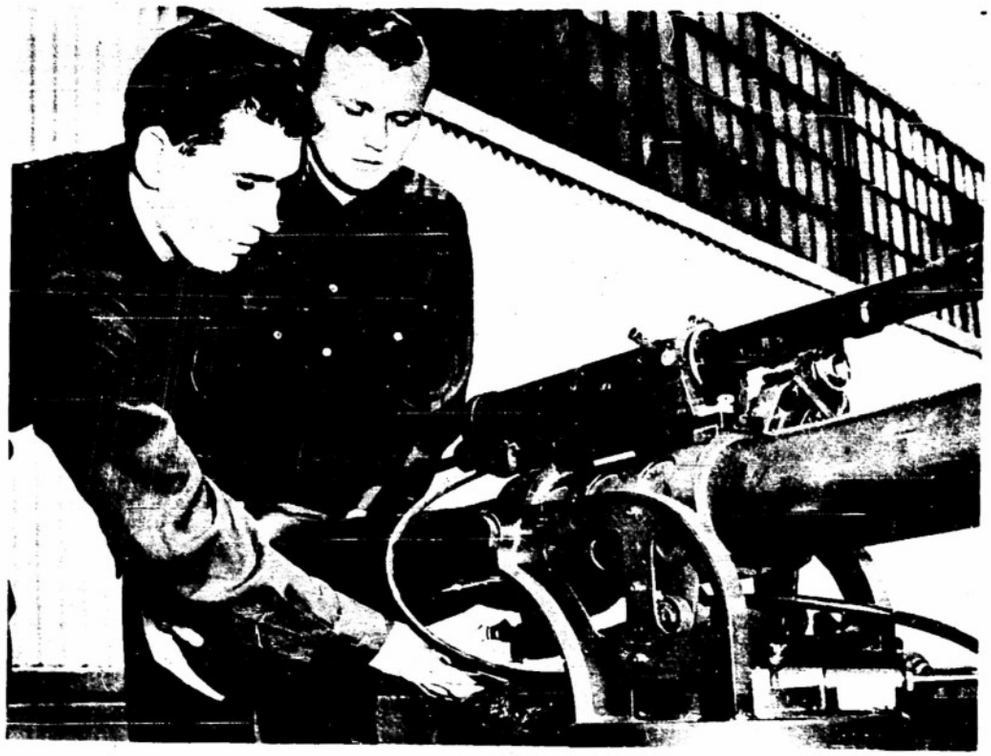

Fig. 10. First Step in Disassembly.
Chamber and Breech Assembly Unlocked, Rotated and Removed.

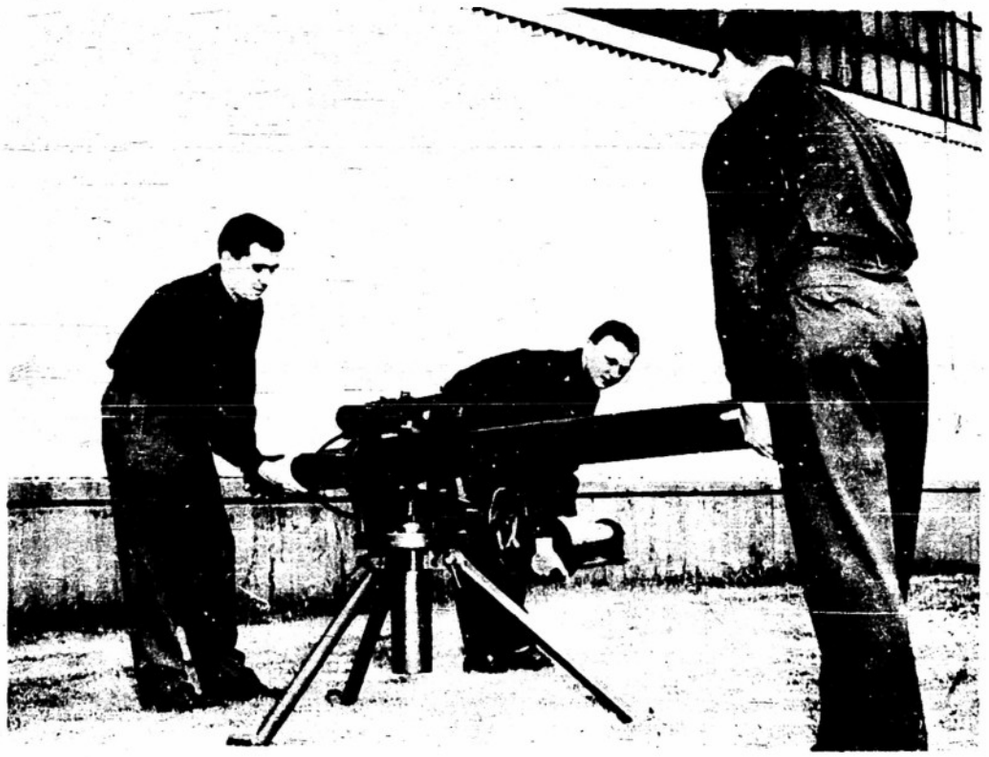

Fig. 11. Second Step in Disassembly.
Chamber and Breech Assembly Removed, Tube Being Removed.

Fig. 12. Three Disassembly Units.

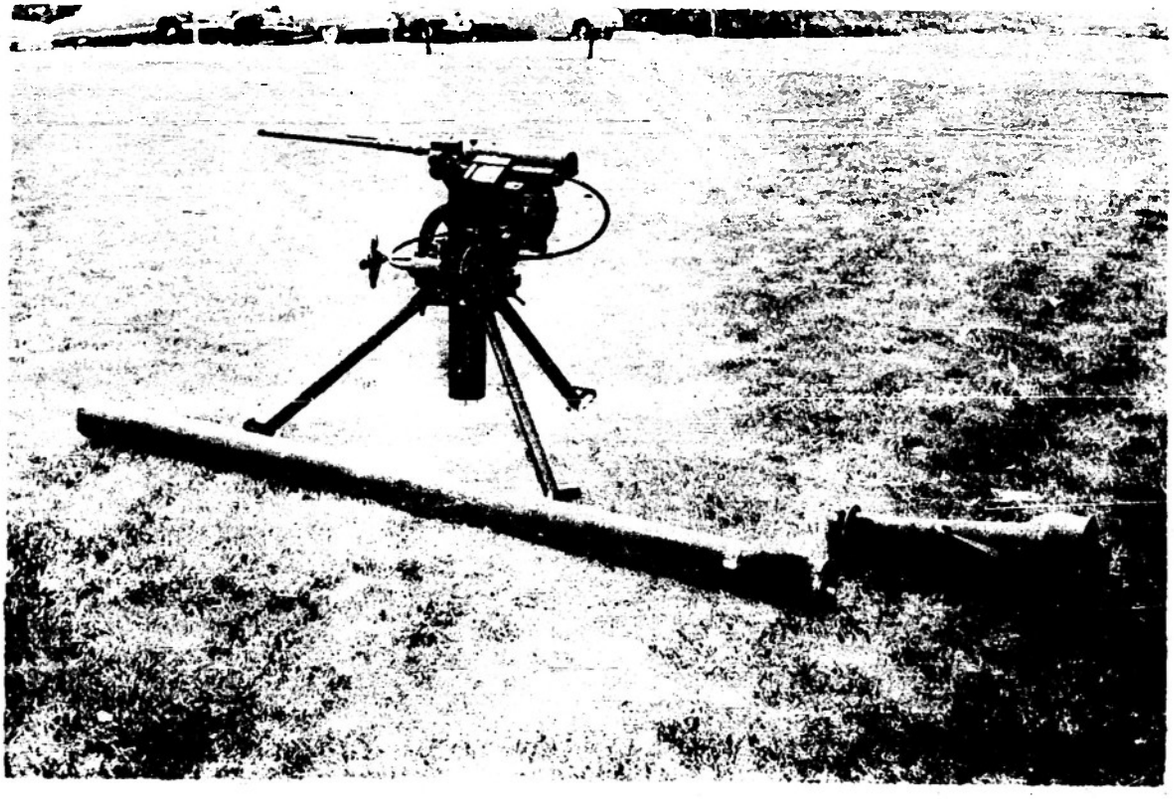

Fig. 13. Close-Up of Three Disassembly Units.

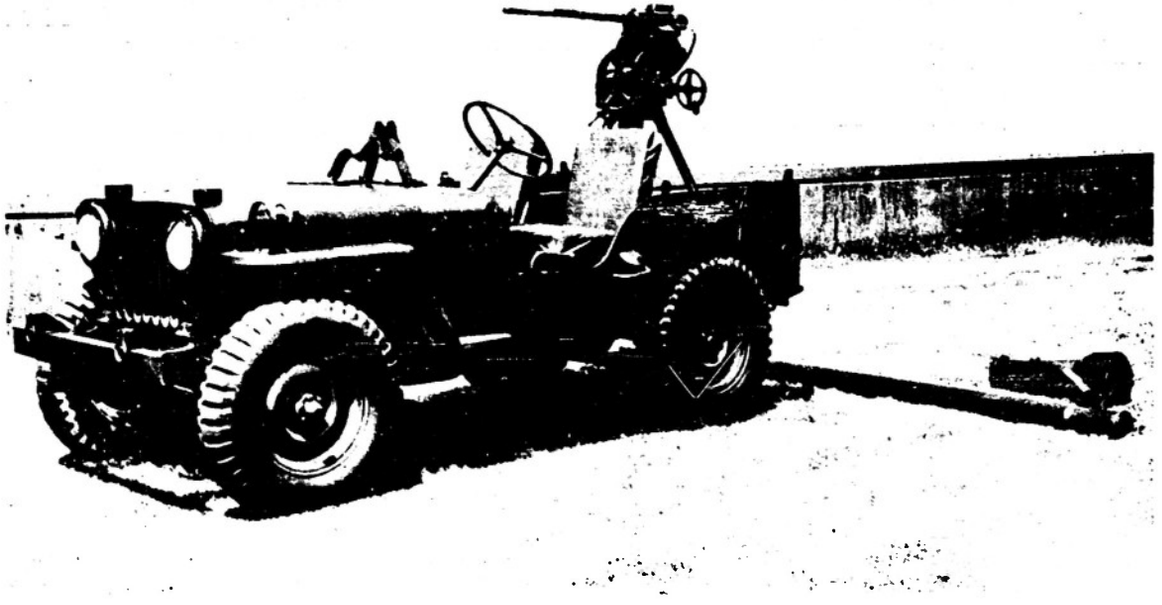

Fig. 14. First Step in Reassembly On Truck.
Mount Assembly in Position.

Fig. 15. Second Step in Reassembly.
Mount Assembly and Tube in Position.

Fig. 16. Weapon Assembly and Three-Man Firestone Crew.
Chamber and Breech Assembly in Position, Rifle in Travel Position.

Penetration Firing

As a part of the demonstration of May 19 three T-138 HEAT rounds were fired from the T-137 El rifle. The homogeneous armor plate, 5-in. thick and at an obliquity of 60 degrees, was placed at a range of 500 yards. The three rounds (Lot PA-E 9404 functioned and effected complete penetration of the armor.

Accuracy Firing

The accuracy demonstration with the BAT system consisted of firing the spotting rifle to "line-in" on a moving target and then firing the major caliber weapon. These firings were conducted from both the jeep and ground mount. The target, a tank silhouette, was moving perpendicular to the line of fire at a range of approximately 900 yards.

Two types of ammunition, T-138 and T-119, were fired in the tests. Figures 17, 18, 19 and 20 show the weapon in operating position on truck and ground.

Three rounds of T-138 E57 ammunition were fired from the T-137 El rifle, mounted on a jeep and three hits were obtained on the target.

Three rounds of T-138 E57 ammunition were fired from the T-137 El rifle mounted on the ground and one hit was obtained on the target.

Four rounds of T-119 ammunition were fired from the T-137 El rifle mounted on the ground and three hits were obtained on the target.

Procedure in T-138 E57 Firing

(1) Move up into position on the firing line.

(2) Line-in on the target with the spotting rifle.

(3) Fire 3 rounds of T-138 E57 projectiles (inert).

(4) Remove the weapon from the jeep and place on the ground in the firing position.

(5) Line-in on the target with the spotting rifle.

(6) Fire 5 rounds of T-138 E57 HEAT (inert) ammunition.

Procedure in T-119 Firing

The details of the T-119 firing are contained in the section of this report titled T-119 PROJECTILE. The procedure in the firing was:

(1) Line-in on the target with the spotting rifle.

(2) Fire 3 rounds of T-119 ammunition.

The system tests indicated a high percentage of first round hits with the major caliber weapon. On all of the above tests from jeep and ground and with both T-138 E57 and T-119 ammunition the first round fired with the major caliber weapon hit the target.

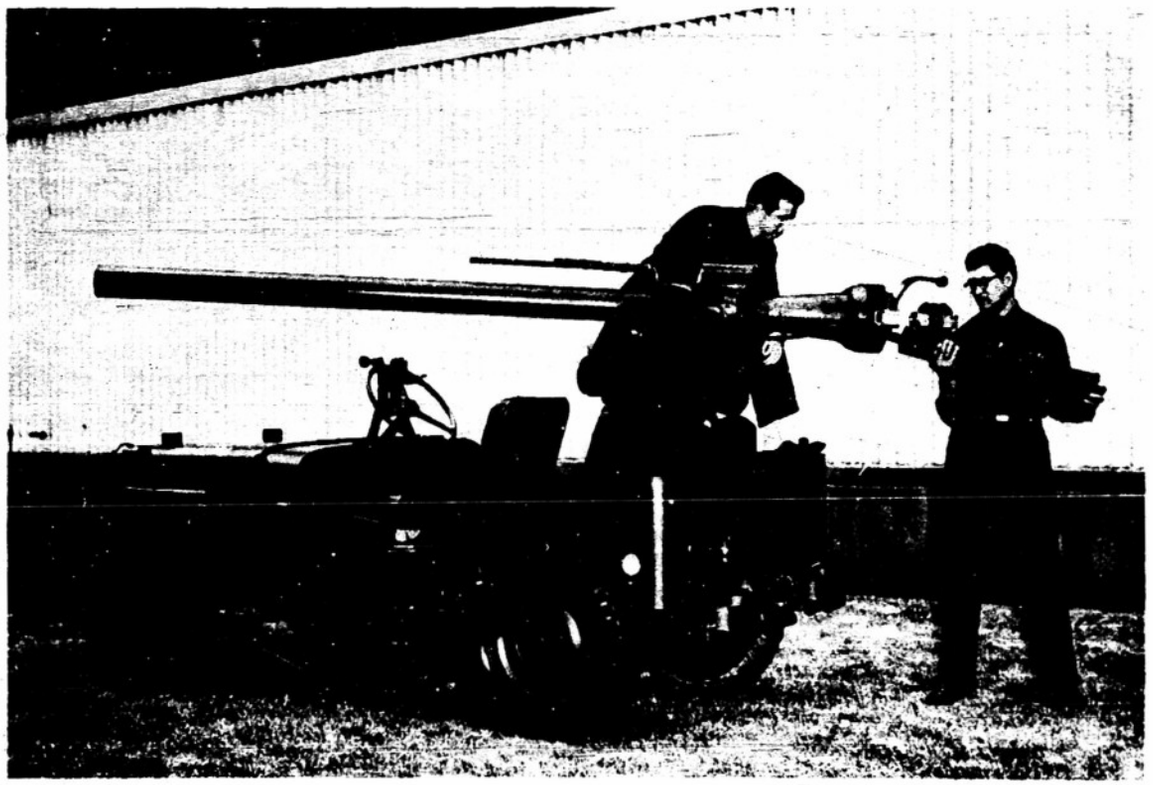

Fig. 17. Weapon Assembly and Firestone Firing Crew.
Gunner at Controls, Assistant in Position to Service Spotting Rifle and to Operate Breech; Loader Inserting T-138 E57 Cartridge.

Fig. 18. Weapon Assembly and Firestone Firing Crew.
Gunner at Controls. Assistant in Position to Service Spotting Rifle. Loader in Readiness With Cartridge Assembly.

Fig. 19. Weapon Assembly and Firestone Firing Crew.
Breech Open, Cartridge Being Inserted. Right Handwheel is Traverse Control. Major Caliber Firing Button in Center of Wheel.

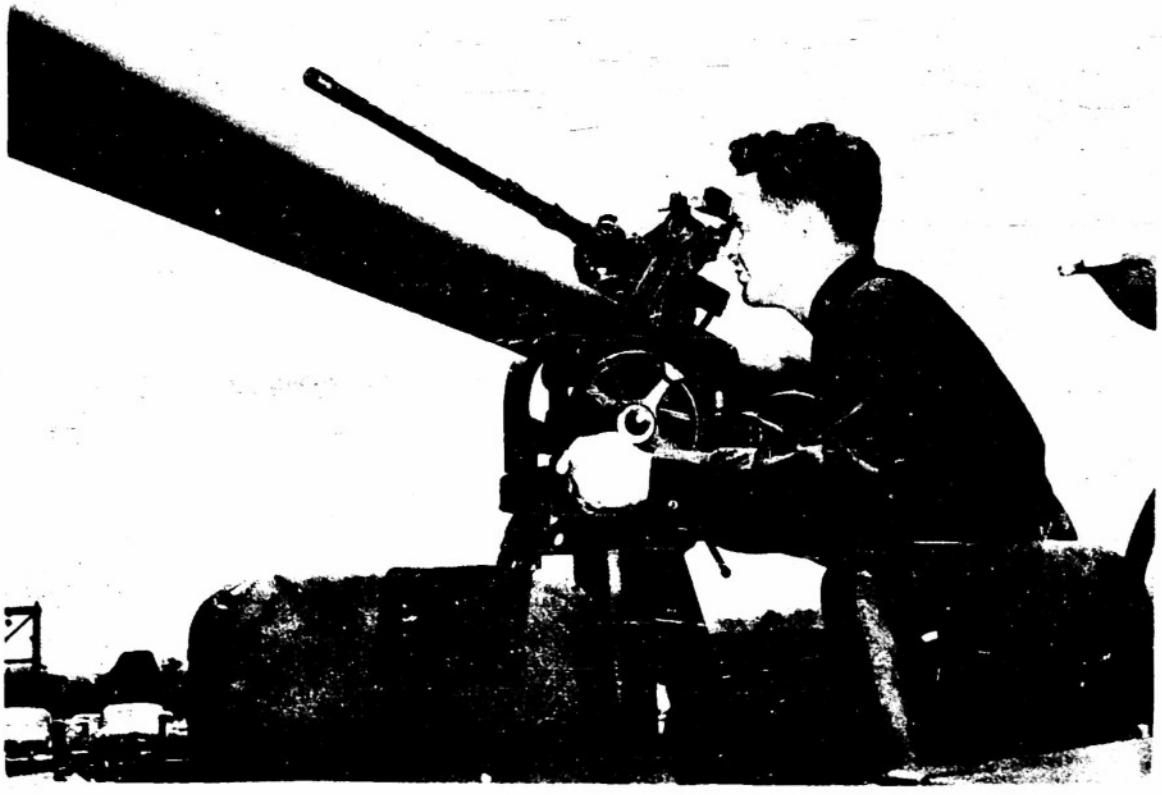

Fig. 20. Gunner at Controls.
Sighting Into M62 E4 Elbow Telescope, Left Hand on Elevation Control, Firing Button for Minor Caliber Rifle in Center of Elevating Handwheel.

THE RIFLE

The Firestone BAT weapon system consists of the following parts: T-137 E1 rifle, T-152 E2 mount, T-46 spotting rifle, T-183 sight mount and M-62 E4 sight, and M-341 E1 indirect sight. The assembly may be mounted on an M-38 1/4-ton truck. Except for the indirect sights, which are not yet available, three complete units, mounted on M-38 trucks, are in use as follows:

Unit 1. Fort Benning, Georgia, for weapon system and ammunition evaluation tests.

Unit 2. Erie Ordnance Depot, Ohio, for weapon system and ammunition evaluation tests.

Unit 3. Defense Research Division, Firestone, Akron, for engineering design studies.

A fourth unit, consisting of a T-137 E1 rifle, T-152 E2 mount, T-183 sight mount, and an M-62 E4 sight, is in use at Aberdeen Proving Ground for ammunition evaluation tests.

The major components for four additional T-137 E1 rifles have been manufactured and are available in Akron. T-152 E2 mounts are being manufactured, and M-64 E4 sights have been allocated for use with additional units.

Informal Evaluation Tests

A Firestone BAT weapon system was delivered to Army Field Forces, Board No. 3, at Fort Benning, Georgia, during the week of May 4, 1952. The board set up a tentative test schedule for the informal evaluation of the weapon system and it is anticipated that a report from the board will be forthcoming when the evaluation has been completed.

New Developments

A reversed flow propellant-shell case system has been devised and is being constructed. The essential difference between this and the more conventional system is that the propellant is contained in an annular section of the shell case and upon burning, the exhaust gases discharge inwardly through the perforations of the inner wall and leave the chamber through a single center venturi. The principle of operation is disclosed in Figure 21 which shows how a T-19 chamber may be modified to evaluate this development.

One or more of the following advantages may result from the use of the reversed flow system:

(1) Reduction in the amount of unburned powder. If the powder can be initiated properly on the inner surface it would burn so that all unburned powder would be trapped in the annular chamber.

(2) Considerable reduction in the weight of the breech mechanism. If the central nozzle is made an integral part of the shell case the balancing thrust can be transmitted through the case to the gun and assist in holding the shell case in the chamber during the firing cycle.

(3) Automatic shell case ejection - by using the gas pressure remaining after the projectile has left the gun tube, to eject the spent cartridge case.

(4) Elimination of perforated case - by using a combustible inner case.

(5) Elimination of the breech block - by using the internal chamber pressure to expand the outer shell case sufficiently to lock the case in the chamber.

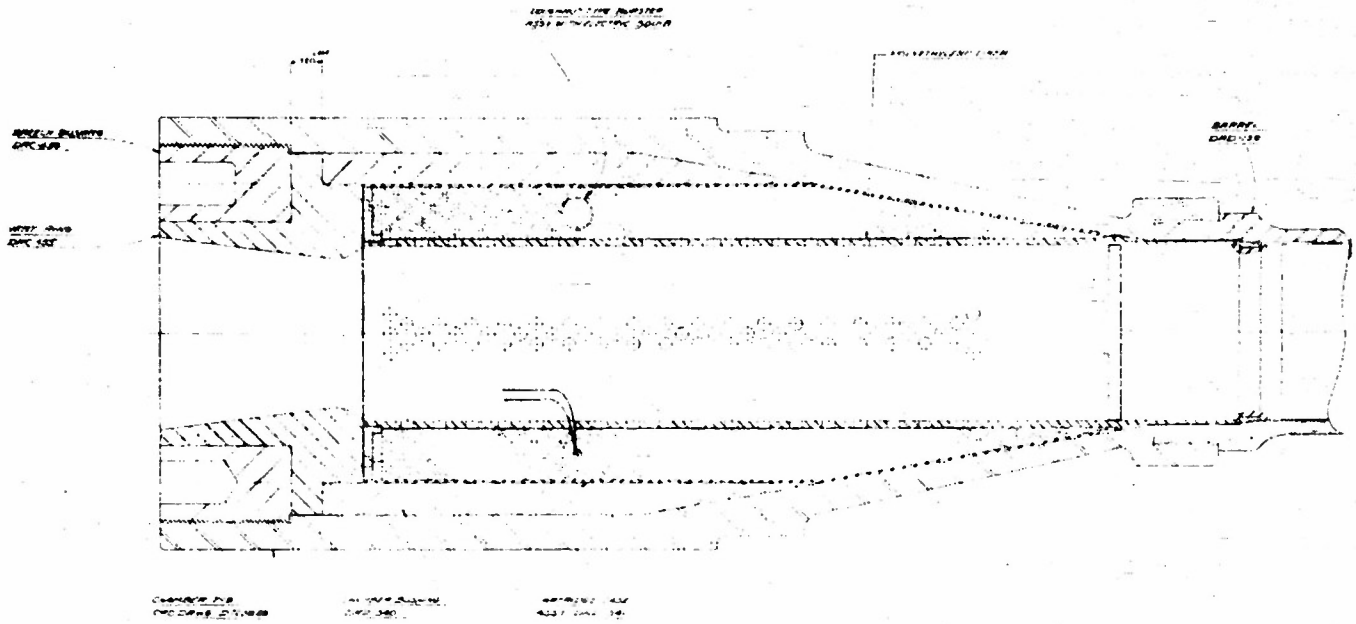

Fig. 21. Test Assembly for Evaluation of Annular Ring of Propellant.

Future Program

1. Evaluation of any design changes that may be suggested as a result of the Fort Benning tests.

2. Conduct trajectory-matching studies of spotting and major-caliber rounds.

3. Conduct stress analysis studies of the T-152 E2 mount using strain gages.

Performance Studies Using T-138 E57 HEAT Projectiles

The Twenty-First Progress Report presented the firing data for thirty-four T-138 E57 HEAT projectiles from Picatinny Arsenal Lot PA-E 9068. Seventy-six additional T-138 E57 projectiles have been tested in an effort to identify the cause or causes for the malfunctions of the rounds in the PA-E 9068 lot. Table I is a summation of the data for the 110 rounds tested. Table II shows similar fuze functioning data for nineteen T-264 WP rounds. These latter are shown because the HEAT and WP rounds employ the same base element and nose element systems.

A discussion of the various tests follows:

Test 1
T-138 E57 Projectiles; Fired Statically Without Rotation; Lot PA-E9404

Two rounds were X-rayed, disassembled and reassembled with the base element rotor in the armed position in each case. Auxiliary M36 detonators were placed in the base element cans with the firing wires running through the tops of the cases. The rounds were suspended horizontally from wires and fired against nine inches of homogeneous armor placed normal to the line of fire.

An attempt was made to detonate the first assembly by striking an auxiliary tee and crystal assembly, located a safe distance from the round, with a 2-lb. hammer. When three blows were without effect a hand generator was attached to the M36 detonator leads and the round detonated and penetrated 7-8 inches of armor.

The second round was similarly suspended and was successfully detonated by the second blow of the two-pound hammer. About 7-8 inches of penetration was achieved.

Test 2
T-138 E57 Complete HEAT Rounds; Fired Against Plate at Normal Incidence; 400-Ft. Range; Lot PA-E9404

Ten projectiles were fired at 400 ft. against homogeneous armor plate at normal incidence. Each of the rounds functioned, the first four penetrating 9 inches of plate and registering on a witness plate seven feet behind the target. The remaining six rounds were fired against 12 inches of armor plate and all functioned. Two rounds penetrated the 12 inches of armor and the remaining four each penetrated between 9.5 and 10.5 in.

Test 3
T-138 E57 Complete HEAT Rounds; Fired Against Plate at 60-degree Obliquity; 500-Yd. Range; Lot PA-E9404

Three projectiles were fired against a target of homogeneous armor plate five inches thick inclined at 60 degrees and located at a range of 500 yards. Each round functioned and perforated the target (Minimum absolute penetration was 10 inches).

Test 4
T-138 E57 Complete HEAT Rounds; Fired Against Plate at 60-degree Obliquity; 400-Ft. Range
5 Rounds of Lot PA-E9507
(With Rubber Pads as Shown in Fig. 22)
5 Rounds of Lot PA-E9508
(Without Rubber Pads as Shown in Fig. 22)
5 Rounds of Lot PA-E9509
(With Rubber Pads as Shown in Fig. 22)
5 Rounds of Lot PA-E9510
(Without Rubber Pads as Shown in Fig. 22)
Lots PA-E9509 and PA-E9510 contained projectiles loaded at same time as those of Lot PA-E9404 of Tests 1, 2 and 3

Having had two shipments of T-138 E57 HEAT projectiles with such different per-

formance records (Lot PA-E 9068 giving 3 functions out of 34 rounds fired and Lot PA-E 9404 giving 10 functions out of ten rounds fired), a third shipment was requested and received from Picatinny Arsenal. This shipment contained 20 rounds of four different lot numbers: PA-E 9507, PA-E 9508, PA-E 9509 and PA-E 9510. Lots PA-E 9507 and PA-E 9508 were loaded on a different date from either the PA-E 9509 and PA-E 9510 lots or the PA-E 9608 lot (See Table I). The ten projectiles of lots PA-E 9509 and PA-E 9510 were loaded with Comp. B at the same time as lot PA-E 9404 (See item (1) Table I). All twenty rounds of the four lots were shipped from Picatinny Arsenal as complete cartridge assemblies (shell case, primer, propellant and projectile). Rubber pads were used with the projectiles of lots PA-E 9507 and PA-E 9509 while pads were omitted in the rounds of lots PA-E 9508 and PA-E 9510 (See Fig. 22).

All four lots were fired the same day. The first projectile from each lot was fired in rotation, followed by the second, third, etc. until all five of each of the four lots were fired.

Three projectiles of Lot PA-E 9507 functioned (3 of 5), four projectiles of Lot PA-E 9508 functioned (4 of 5), three projectiles of Lot PA-E 9509 functioned (3 of 5) and five projectiles of Lot PA-E 9510 functioned (5 of 5) See Table I.

Test 5

T-138 E57 Complete HEAT Rounds; Fired Against Plate at 60-degree Obliquity; Lot PA-E9588; 400-Ft. Range

6 Complete Rounds as Received

4 Rounds With Modified Tee Caps. See Fig. 23

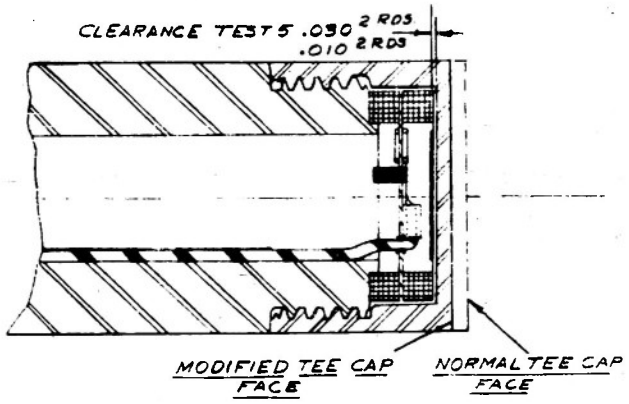

Fig. 23. Modified Tee Caps.
Used in Test 5.

Six projectiles of Lot PA-E 9588 were fired at 60-degree plate at 400-ft. range and failed to function.

Two additional rounds with a tee cap modified so that the front face was 1/16 in. thick instead of the usual 1/8 in. but

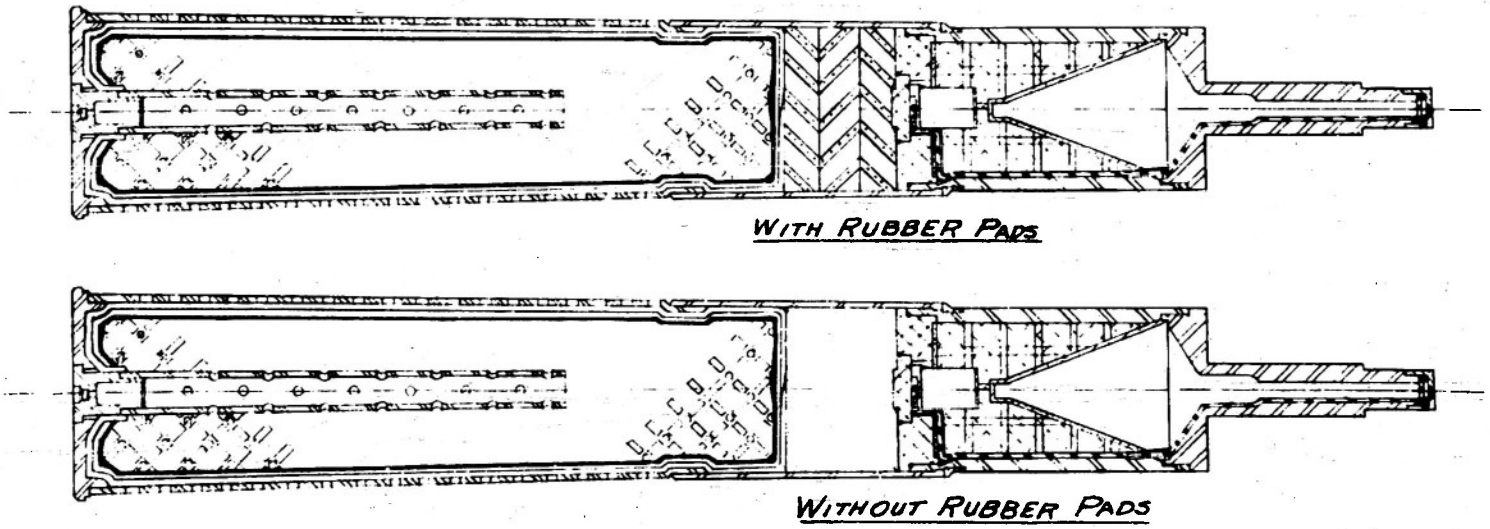

Fig. 22. T-138 E57 Complete HEAT Rounds.
With and Without Rubber Pads.

with the usual clearance (at least .030 in.) between cap and crystal, Fig. 23, failed to function. Two similar rounds (1/16 in. face) with a nominal crystal-to-cap clearance reduced by .020 in. were tested and one round functioned.

Test 6

T-138 E57 Complete HEAT Rounds; Fired Against Plate at 60-degree Obliquity; 400-Ft. Range; Lot PA-E9604

Five rounds of a fifth shipment of projectiles were fired against 60-degree plate at 400 ft. and two of five rounds functioned.

Test 7

T-138 E57 Complete HEAT Rounds; Fired Against Plate at 60-degree Obliquity; 400-Ft. Range; Lot PA-E9605

Five of six rounds functioned when fired against 60-degree plate at 400 ft. and three of four rounds functioned when fired against 60-degree plate at 500 yards.

Test 8

T-138 E57 Complete HEAT Rounds; Fired Against 2-inch Bursting Screen; Without Tee Caps; 400-Ft. Range; Lot PA-E9588; See Fig. 24

Ten rounds of this lot were tested with the tee caps removed (See Fig. 24). They were fired at a 2-in. bursting screen at a range of 400 ft. A five-inch steel plate was placed ten feet behind the wood bursting screen to serve as a witness plate. Eight of the ten projectiles functioned on the bursting screen, as witnessed by the complete shattering of the bursting screen and penetration of the jet and tee into the witness plate. The other two passed through the bursting screen and detonated against the plate. In each case the punctured piece of the bursting screen was found, indicating that the projectile had passed through the 2-in. planks without detonating. Since only one of ten rounds of PA-E 9588 had functioned with tee caps (Test 5) this experiment provided the first positive evidence that, in some manner, the tee cap was interfering with the normal functioning of the crystal assembly.

Test 9

T-138 E57 Complete HEAT Rounds; Fired Against Bursting Screen; 400-Ft. Range; Without Tee Caps; Lot PA-E9068; See Fig. 24

As reported in the Twenty-First Progress Report the rounds of Lot PA-E 9068 had produced a low percentage of functions (3 of 34). Only three rounds from that lot remained and the tee caps were removed from these. (Fig. 24). The rounds were fired as described in Test 8. Two of the three functioned on the bursting screen indicating, again, that a tee cap somehow interferes with the functioning of the fuze assembly.

Test 10

T-138 E57 Complete HEAT Rounds; Fired Against Bursting Screen; 400-Ft. Range; With Cast Iron Tee Caps; Lot PA-E9588

Since the rounds of Lot PA-E 9588 had functioned well without tee caps (Test 8) and poorly with tee caps (Test 5) a modification of tee caps was tested. This modification consisted of a change of

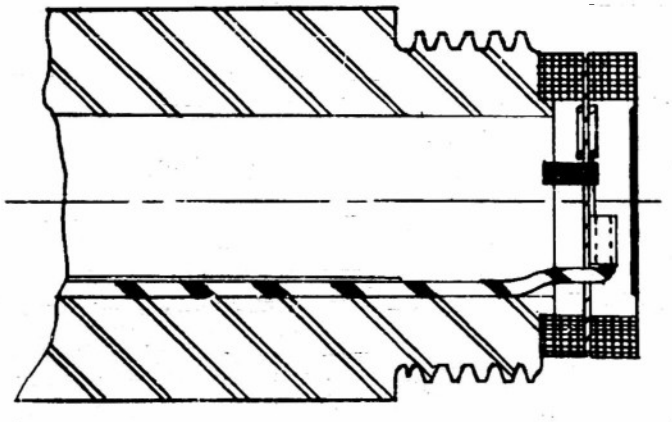

Fig. 24. Tee Without Cap.
Used in Tests 8 and 9.

material from steel to cast iron. Three rounds were fired and all three failed to function on the bursting screen.

Test 11

T-264 (WP) Complete Rounds; Fired Against Wood Bursting Screen; 400-Ft. Range; Lots OAP-E187, 188 and 189

Eight T-264 complete rounds with tee caps were tested and four appeared to function. Three of the four which functioned, however, contained base elements from Lot PA-E 9556 instead of the Lot PA-E 8853 elements which had been used in all previous tests.

Eleven T-264 complete rounds without tee caps were tested and eight functioned. Seven of the eight functioning rounds and all of the non-functioning rounds contained base elements from PA-E 8853.

Discussion

Since such a large proportion of the T-138 E57 rounds have failed to function, and a much higher proportion function when the tee caps are removed, it is clearly indicated that the nose element assembly encased in the standard tee cap does not deliver sufficient energy to the detonator to assure functioning. Since some lots of rounds with tee caps have shown a high level of functioning-PA-E 9404, 9507-9510, 9605-it appears that the energy required for detonating the T18 detonators is quite variable and that the energy generated by the crushing of the nose element is prevented from reaching the detonator by some mechanism, not yet understood, which involves the tee cap. Experiments, designed to eliminate the various possibilities, are being conducted.

Table I
Functioning Data on T-138 E57 HEAT Projectiles
For 110 Rounds Tested

Date	Picatinny Loading Group No.	Test No.	Picatinny Shipping Lot No.	Base Element Lot No.	Number Fired	Number Functioned	Target and Range	Remarks
** April	2*		PAE9068	PAE8853	34	3	See 21st Monthly Report	5-PAE Base Elements Used.
4-29	1*	1	PAE9404	PAE8853	2	2*	Static Firing	One projectile was detonated by auxiliary detonator.
5-2	1*	2	PAE9404	PAE8853	10	10	Normal to plate 400 ft.	
5-7	3*	4	PAE9507	PAE8853	5	3	60° to plate at 400 ft.	Standard complete round.
5-7	3*	4	PAE9508	PAE8853	5	4	60° to plate at 400 ft.	Complete round less 3 rubber shock pads.
5-7	1*	4	PAE9509	PAE8853	5	3	60° to plate at 400 ft.	Standard cone plate round.
5-7	1*	4	PAE9510	PAE8853	5	5	60° to plate at 400 ft.	Complete round less 3 rubber shock pads.
5-15	3*	5	PAE9588	PAE8853	6	0	60° to plate at 400 ft.	Complete round
					2	0	60° to plate at 400 ft.	Tee cap 1/16" thick .030 clearance.(Min.)
					2	1	60° to plate at 400 ft.	Tee cap 1/16" thick .010 clearance.(Min.)
5-15	1*	6	PAE9604	PAE8853	5	2	60° to plate at 400 ft.	Complete round
5-15	3*	7	PAE9605	PAE8853	6	5	60° to plate at 400 ft.	Complete round
5-15	3*	7	PAE9605	PAE8853	1	1	60° to plate at 500 yds.	Complete round
5-15	3*	7	PAE9605	PAE8853	3	2	60° to plate at 500 yds.	Complete round
5-19	1*	3	PAE9404	PAE8853	3	3	60° to plate at 500 yds.	Complete round
6-3	3*	8	PAE9588	PAE8853	10**	8	2" wood bursting screen at 400 ft. - steel witness plate at 10 ft.	No tee cap
6-3	2*	9	PAE9068	PAE8853	3	2	2"wood bursting screen at 400 ft. - steel witness plate at 10 ft.	No tee cap
6-3	3*	10	PAE9588	PAE8853	3	0	2" wood bursting screen at 400 ft. - steel witness plate at 10 ft.	Cast iron tee cap

*All projectiles were loaded at Picatinny Arsenal, in one of 3 groups as indicated
**These rounds had their base elements removed and the electrical circuit checked prior to reassembly and firing.

Table II
Functioning Data on T-264 WP Projectiles
19 Rounds Tested

Date	Edgewood Arsenal Lot No.	Type of Round and Burster Tube Size	No. Fired	No. Functioned	Target and Range	Remarks
6-2	OAP-E 187	WP Small Burster	3	0	1" Wood @ 400 ft.	Two functioned on ground behind target. Tee cap in place.
6-2	OAP-E 187	WP Small Burster	2	0	4" Wood @ 400 ft.	Tee cap in place.
6-2	OAP-E 187	WP Small Burster	2	1	1" Wood @ 400 ft.	No tee cap. The shoulder of the round that did not function hit a metal box before nose hit target.
6-2	OAP-E 189	WP Large Burster	4	3	4" Wood @ 400 ft.	No tee cap. Lot PAE 9556 Base Elements.
6-2	OAP-E 189	WP Large Burster	1	1	4" Wood @ 400 ft.	Tee cap in place. Lot PAE9556 Base Elements.
6-2	OAP-E189	WP Medium Burster	6	6	4" Wood @ 400 ft.	No tee cap. Lot PAE 8853 Base Elements.
6-2	OAP-E 189	WP Large Burster	1	1	4" Wood @ 400 ft.	No tee cap. Lot PAE 8852 Base Elements.

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T-171 PROJECTILE

There were no firings involving the T-171 projectile during the month of May.

T-119 PROJECTILE

The only firing test with the T-119 projectile during the past month was associated with the demonstration of BAT weapons and ammunition held at Aberdeen Proving Ground on May 19, 1952. That portion of the demonstration involving the T-119 projectile consisted of firing inert rounds at a tank silhouette moving approximately perpendicular to the line of fire at a range of approximately 900 yards.

A weapon assembly consisting of a T-137 E1 rifle equipped with a tube rifled one turn in 200 calibers, a T-152 E2 mount, a T-46 caliber .50 spotting rifle, a T-183 sight mount and an M62 E4 elbow telescope was used. The rifling of the tube, and the range scales on the sights were designed specifically for the T-138 E57 projectile. Since the T-119 had performed satisfactorily in earlier accuracy tests, when launched from either a smooth bore or rifled tube (1 in 20), the use of the 1-200 tube was not expected to cause trouble. Since the trajectories of the T-138 E57 and the T-119 projectiles do not coincide, and since the sights had range scales for the T-138 E57, it was necessary to adjust the velocity of the T-119 so that, at the range of 900 yards, the two trajectories matched. It was found that a fair match could be obtained at a muzzle velocity of 1704 ft/sec using 7 lb. 11 oz. of M10 MP propellant, Lot PA 30242. The required velocity for the T-138 E57 was 1720-1730 ft/sec. The charge development data are shown in Table III.

Four T-119 projectiles were fired from the ground at the moving target and three struck the target. One of the three hits was obtained on the first round fired from the major caliber. This test demonstrates again that the T-119 projectile has an effective accuracy when fired from the rifled T-137 E1 gun.

Future Program

1. Projectiles have been assembled for a combined accuracy and penetration test. Sixteen projectiles will be live-loaded. The firing of these projectiles is planned during the last two weeks of June.

2. The manufacture of a pilot lot of 500 T-119 production-type projectiles is continuing. A forged aluminum fin will be used with these rounds and the first dies have been cut.

Table III
Range Data — T-119 Projectile
To Establish Charge
Aberdeen Proving Ground, May 16, 1952

Date 5-16-52 Program _____

PROJECTILE
Model T-119
Type _____
Weight (Nominal) 17.6 lbs.
C.G. Location 7.23 in from hinge pin ℄
Bourrelet Dia. (Nom.) 4.190 +.002
Special Features 40 min. canted fins
Fired from rifled tube
With no rotating band.

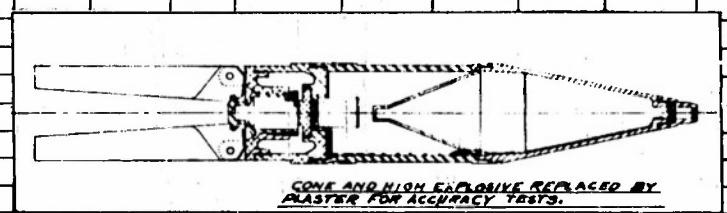
COMPONENT PARTS
Nose - DRC 342-3
Nose Cap - DRA 489-3
Body - DRC 392
Chamber - DRC 393-1
Housing - DRB 197-2
Piston - DRB 198-5
Stop - DRA 173-3
Fins - DRB 285 (40' cant)
Base Plug - DRA 288-9
Base Element - DRA 264 (Dummy)

TEST GUN
Model T-139E1; Ground Mount T15E2
Type 105 mm Recoilless Rifle
Length of Tube 95 in.
Twist of Rifling 1-20D
Sighting Equipment Direct Sight - Elbow M62E4
With Ballistic Reticle. On T183 Sight Mount
Bore Dia. (Lands) 4.134 +.002 nom
Case - T-53
Primer - T-81
Polyethylene & Rayon Liner

MISCELLANEOUS DATA
Range Approx. 950 yds.
Target 20 ft. × 20 ft.
Propellant
Type M10 MP web .033 in. Charge 1ft. Variable
Lot No. PA 30242
Proof Director J. FARRELL
Observers V.E. Lucas; Firestone Gun Crew

Round No.	Time of Flight	Proj. Weight	Powder Charge lb. oz.	Wind Vel. & Dir.	Chamber Pressure (a)	Muzzle Velocity Instr.	Muzzle Velocity Actual	Elev. (b)	Azimuth	Position of Hit (mils) Vert.	Position of Hit (mils) Horiz.	Observations
-1			8 - 0		12 000	1765	1783	950	0	—	—	Flight not observed. Apparently over target
-2			8 - 0		12 600	—	—	900	0	+1	+1.5	Good flight
148 - 3		17.56	7 - 13		12 000	1717	1733	950	0	+1	+1.6	Good flight
143 - 4		17.63	7 - 11		11 300	1688	1704	900	0	Missed		Observed to fly loud and just to right. Good flight.

Note: (a) M3, Internal Copper
(b) Elevation was adjusted with a reticle inscribed for T139E57 Projectile and the elevation values are given in yards range.
(c) Observation of last two rounds was by search light.


CONE AND HIGH EXPLOSIVE REPLACED BY PLASTER FOR ACCURACY TESTS.

Center of Impact _____
Probable Error — Vertical _____
Probable Error — Horizontal _____

Signed - C.M. Cox

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PENETRATION STUDIES

Comparison of Target Materials

A penetration program to study the comparative resistances of various target materials to shaped charges has been completed. Targets of mild steel, lead, gray cast iron, 302 stainless steel plate and 302 cast stainless steel have been used. Table IV shows the penetration data. The lead and cast iron plates were fragmented by the blast as well as penetrated.

Table IV
Comparison of Target Plate Material
21 Rounds Fired at Erie Ordnance Depot

Round No.	Spin Rate (rev / sec)	Standoff (inches)	Penetration (inches)	Target Material
P525	0	7 1/2	25.06	Lead Target
P529	0	7 1/2	21.66	Lead Target
			Avg. 23.36	
P526	0	7 1/2	21.00	Cast Iron
P532	0	7 1/2	19.00	Cast Iron
P535	0	7 1/2	18.38	Cast Iron
			Avg. 19.46	
P517	0	7 1/2	17.00	Mild Steel
P518	0	7 1/2	18.56	Mild Steel
P519	0	7 1/2	17.00	Mild Steel
P520	0	7 1/2	18.38	Mild Steel
P527	0	7 1/2	17.92	Mild Steel
P533	0	7 1/2	15.94	Mild Steel
P536	0	7 1/2	16.81	Mild Steel
			Avg. 17.37	
P528	0	7 1/2	17.50	5x5x1 Stainless
P531	0	7 1/2	16.92	5x5x1 Stainless
P534	0	7 1/2	17.75	5x5x1 Stainless
			Avg. 17.39	
P530	0	7 1/2	16.25	5x5x3 Stainless
P538	0	7 1/2	16.25	5x5x3 Stainless
P539	0	7 1/2	17.37	5x5x3 Stainless
P540	0	7 1/2	15.81	5x5x3 Stainless
P522	0	7 1/2	17.06	5x5x3 Stainless
P523	0	7 1/2	17.00	5x5x3 Stainless
			Avg. 16.62	

The 302 stainless steels used in this experiment had the following hardness:

	BHN	R_B
Rolled 1-in. plate	207-228	85-91
Cast 3-in. plate	149-163	78-80

Study of Spitback Tubes

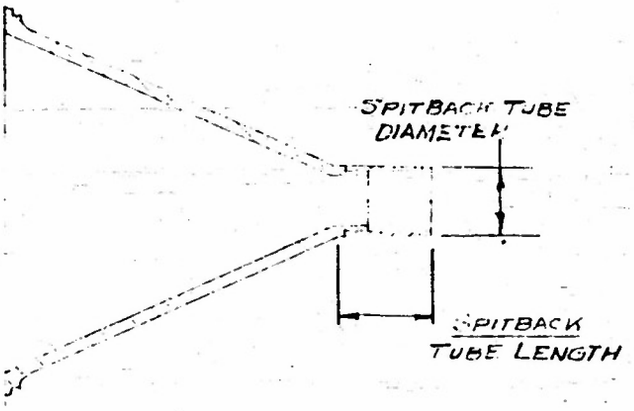
Effect of Length and Diameter On Penetration.

A comparison of the penetrations produced by 45-degree machined cones (DRB 2, .100-in. wall) having spitback tubes of different lengths and diameters has been made. The data are presented in Table V. The length of the spitback tube is measured from the top of the tube to the intersection of the tube with the conical section.

Figure 25 shows the accumulated data for various lengths of spitback tubes and Figure 26 shows the results for various diameters of spitback tubes. There is a slight increase in penetration with increase in the length of the spitback tube but the effect of increasing the diameter of the spitback tube is much more pronounced over the range investigated.

Increasing the length of the spitback tube from .25 in. to 2.80 in. increased the average penetration .7 in., from 17.36 to 18.18 in; increasing the diameter of the tube from .25 in. to 1.0 in. increased the average penetration by approximately 2.5 in. from 16.7 to 19.1 in.

Table V
Effect of Spitback Tubes
To Study Effect of Length and Diameter
81 Rounds Fired at Erie Ordnance Depot



Round No.	Spitback Tube		Spin Rate (rev/sec)	Standoff (inches)	Penetration (inches)	Loaded
	Length (in.)	Diameter (in.)				
Effect of Length						
FS323	.25	.62	0	7 1/2	17.9	Rav. Lot 4
FS324	.25	.62	0	7 1/2	17.9	
FS325	.25	.62	0	7 1/2	17.8	
FS326	.25	.62	0	7 1/2	17.8	
FS327	.25	.62	0	7 1/2	16.8	
					Avg. 17.6	
FS223	.25	.62	0	7 1/2	17.38	PA-E 7003
FS224	.25	.62	0	7 1/2	17.44	
FS225	.25	.62	0	7 1/2	17.44	
FS226	.25	.62	0	7 1/2	17.88	
FS227	.25	.62	0	7 1/2	17.75	
					Avg. 17.58	

Table V (Cont.)

Round No.	Spitback Tube Length (in.)	Spitback Tube Diameter (in.)	Spin Rate (rev/sec)	Standoff (inches)	Penetration (inches)	Loaded
Effect of Length (Cont.)						
FS282	.25	.62	0	7 1/2	17.56	Rav. Lot 3
FS294	.25	.62	0	7 1/2	17.69	
FS295	.25	.62	0	7 1/2	17.25	
					Avg. 17.50	
FS328	.25	.62	0	7 1/2	16.06	Rav. Lot 5
FS329	.25	.62	0	7 1/2	16.81	
FS330	.25	.62	0	7 1/2	18.18	
FS331	.25	.62	0	7 1/2	16.81	
FS332	.25	.62	0	7 1/2	17.06	
					Avg. 16.98	
FS333	.25	.60	0	7 1/2	17.62	Rav. Lot 6
FS334	.25	.60	0	7 1/2	16.69	
FS335	.25	.60	0	7 1/2	16.38	
FS336	.25	.60	0	7 1/2	17.31	
FS337	.25	.60	0	7 1/2	17.94	
					Avg. 17.19	
FS304	.25	.62	0	7 1/2	17.25	Rav. Lot 7
FS305	.25	.62	0	7 1/2	17.31	
FS306	.25	.62	0	7 1/2	17.56	
					Avg. 17.37	
P407	1	.62	0	7 1/2	17.8	PA-E 7746
P408	1	.62	0	7 1/2	17.1	
P409	1	.62	0	7 1/2	17.4	
P410	1	.62	0	7 1/2	17.3	
P416	1	.62	0	7 1/2	17.8	
					Avg. 17.5	
P406	1.6	.62	0	7 1/2	Low Order	PA-E 7746
P417	1.6	.62	0	7 1/2	17.0	
P418	1.6	.62	0	7 1/2	15.7	
P419	1.6	.62	0	7 1/2	17.2	
P420	1.6	.62	0	7 1/2	16.2	
					Avg. 16.5	
P426	2.8	.62	0	7 1/2	18.2	Rav. Lot 4
P427	2.8	.62	0	7 1/2	18.3	
P428	2.8	.62	0	7 1/2	17.9	
P429	2.8	.62	0	7 1/2	18.1	
P430	2.8	.62	0	7 1/2	18.1	
					Avg. 18.1	

Table V (Cont.)

Round No	Spitback Tube Length (in.)	Spitback Tube Diameter (in.)	Spin Rate (rev/sec)	Standoff (inches)	Penetration (inches)	Loaded
Effect of Length (Cont.)						
FS1	2.8	.62	0	7 1/2	18.0	PA-E 4155
FS2	2.8	.62	0	7 1/2	19.0	
FS3	2.8	.62	0	7 1/2	16.3	
FS4	2.8	.62	0	7 1/2	18.2	
FS5	2.8	.62	0	7 1/2	19.5	
					Avg. 18.4	
FS11	2.8	.62	0	7 1/2	17.38	PA-E 4947
FS12	2.8	.62	0	7 1/2	16.50	
FS13	2.8	.62	0	7 1/2	17.31	
FS14	2.8	.62	0	7 1/2	18.50	
FS15	2.8	.62	0	7 1/2	18.44	
					Avg. 17.33	
FS121	2.8	.62	0	7 1/2	17.38	PA-E 5589
FS122	2.8	.62	0	7 1/2	18.50	
FS125	2.8	.62	0	7 1/2	17.63	
FS151	2.8	.62	0	7 1/2	19.69	PA-E 5871
FS152	2.8	.62	0	7 1/2	18.06	
FS153	2.8	.62	0	7 1/2	17.88	
					Avg. 18.19	
FS203	2.8	.62	0	7 1/2	18.31	PA-E 7003
FS204	2.8	.62	0	7 1/2	17.75	
FS205	2.8	.62	0	7 1/2	17.88	
					Avg. 17.98	
FS245	2.8	.62	0	7 1/2	17.81	PA-E 8241
FS250	2.8	.62	0	7 1/2	17.31	
FS242	2.8	.62	0	7 1/2	18.50	
FS275	2.8	.62	0	7 1/2	18.75	PA-E 7770
FS276	2.8	.62	0	7 1/2	19.38	
FS277	2.8	.62	0	7 1/2	17.50	
					Avg. 18.21	
P391	2.8	.62	0	7 1/2	17.93	PA-E 7746
P392	2.8	.62	0	7 1/2	20.68	
P393	2.8	.62	0	7 1/2	13.93*	
P394	2.8	.62	0	7 1/2	17.93	
P395	2.8	.62	0	7 1/2	20.18	
					Avg. 19.18	

*omitted

Table V (Cont.)

Round No.	Spitback Tube Length (in.)	Spitback Tube Diameter (in.)	Spin Rate (rev/sec)	Standoff (inches)	Penetration (inches)	Loaded
Effect of Diameter						
P426	2.8	.62	0	7 1/2	18.2	Rav. Lot 4
P427	2.8	.62	0	7 1/2	18.3	
P428	2.8	.62	0	7 1/2	17.9	
P429	2.8	.62	0	7 1/2	18.1	
P430	2.8	.62	0	7 1/2	18.1	
					Avg. 18.1	
P431	2.8	1.00	0	7 1/2	19.9	Rav. Lot 4
P432	2.8	1.00	0	7 1/2	19.6	
P433	2.8	1.00	0	7 1/2	19.1	
P434	2.8	1.00	0	7 1/2	18.6	
P435	2.8	1.00	0	7 1/2	18.3	
					Avg. 19.1	
P436	2.8	.25	0	7 1/2	16.8	Rav. Lot 4
P437	2.8	.25	0	7 1/2	17.2	
P438	2.8	.25	0	7 1/2	16.3	
P439	2.8	.25	0	7 1/2	16.3	
P440	2.8	.25	0	7 1/2	16.5	
					Avg. 16.7	

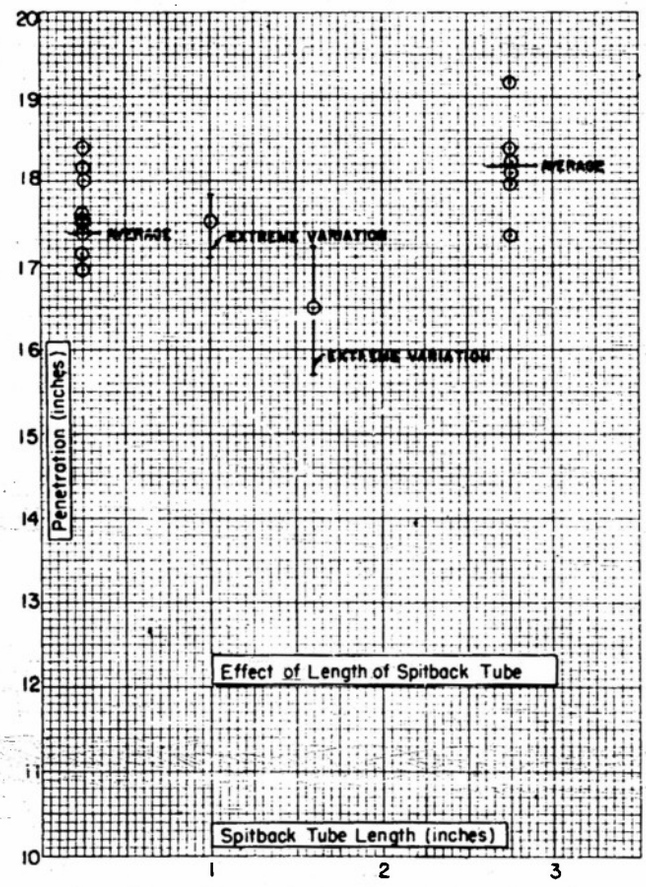


Fig. 25. Effect of Length of Spitback Tube.

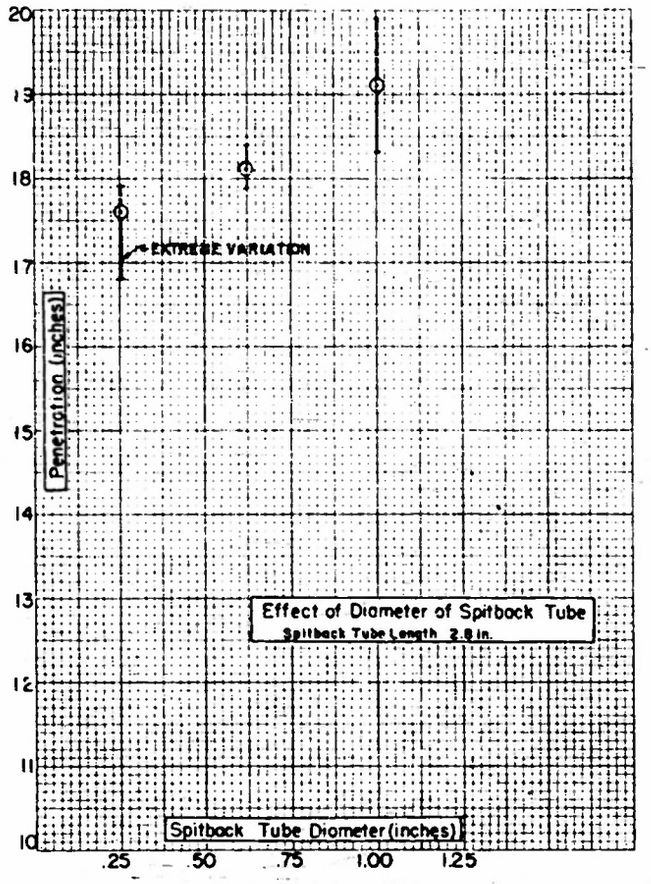


Fig. 26. Effect of Diameter of Spitback Tube.

Future Program

1. Evaluation of the penetration of DRB 2 (.100-inch wall) cones in T-171 assemblies.

2. Penetration versus standoff for 45° and 20° copper cones (.100-inch wall) with the head of H.E. held constant at 3.63 inches.

3. Effect of rotation upon drawn DRB 398 cones.

4. Evaluation of the influence of DRC 314 tees made of (a) mild steel, (b) high ductility malleable iron, and (c) low ductility malleable iron.

5. Comparison between DRC 314 tees and nose rings with respect to their effect upon penetration.

Firing Tests of T-267 Fuze

Two firing programs involving Fuze, PIBD T-267 E11, shown in Figure 27, are reported.

Ten inert fuzes mounted in inert loaded T-138 E57 projectiles were fired into the recovery box. Eight of the ten base elements functioned completely, the rotor in one failed to turn and in the remaining one the M-2 delay element was assembled backwards and failed to function. Table VI is a copy of the firing record.

Five fuzes with detonators were fired through a two inch bursting screen into a recovery box. Three of the rounds were set for .05 sec. delay action and all functioned. The remaining two were set for superquick or electrical action. One functioned as intended while the other failed to function; presumably because the rotor split at the thinnest point. The weak section can be strengthened by a slight modification. In this fuze the M-2 delay element and the M21 detonator were not set off by the detonation of the T-18, a hopeful indication of detonator safety. Table VII is a copy of the firing record.

Modification to PD T-223 E1 Fuze

Preliminary to the loading of fifteen PD T-223 E1 fuzes, a retest of the initiation of the M-21 detonator by the M2 delay element was made. This retest was necessary because two of five fuzes had failed in a previous test. After the cross hole between the cavities for the

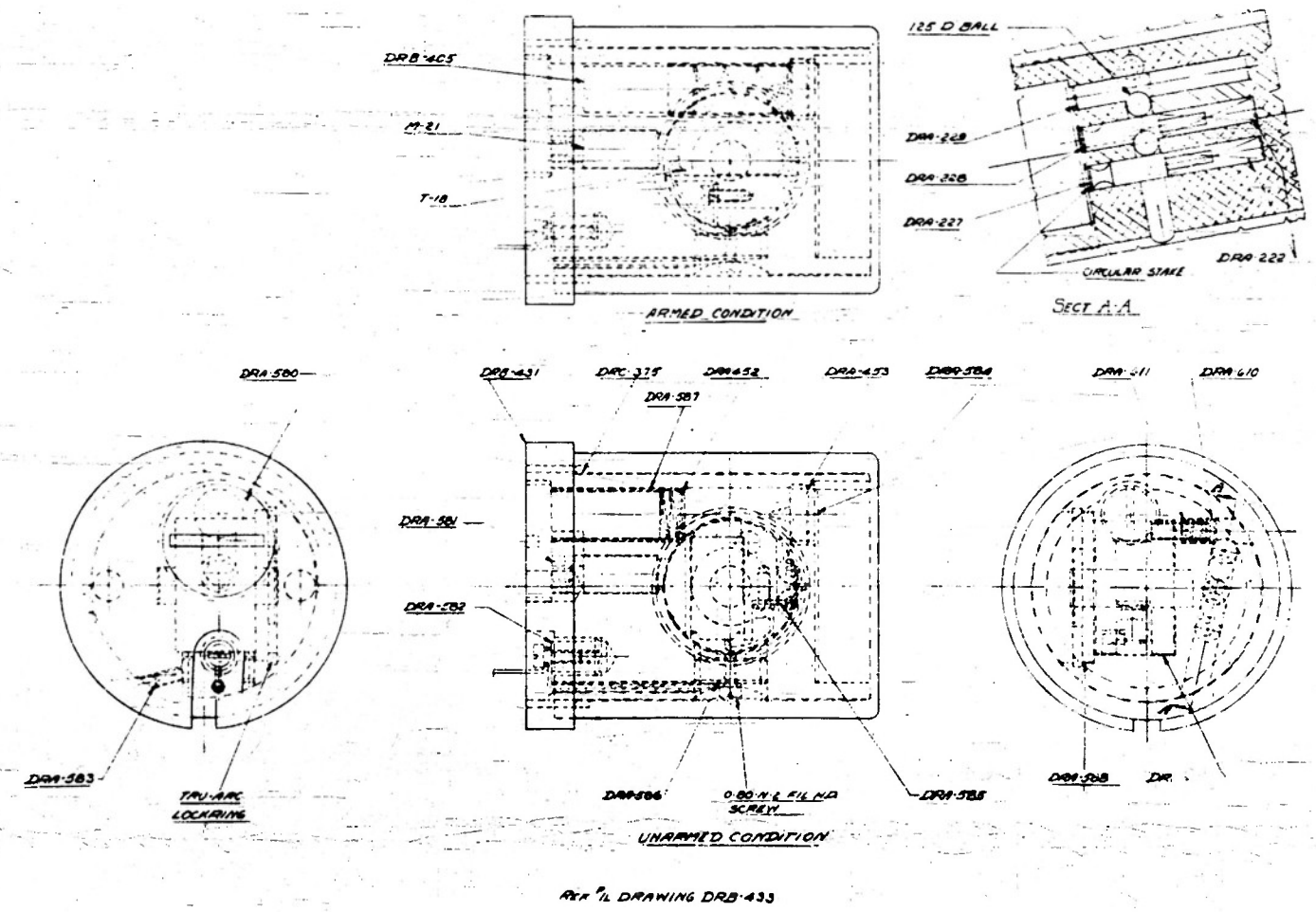


Fig. 27. PIBD T-267 E11 Fuze.

detonator and delay element had been enlarged, as shown in DRD 250-4, three fuzes were tested and all functioned; one with the small hole failed to function.

Performance Tests With PD T-222 E4 Fuze

(T-222 E3 Nose Element, and FBE-6 Base Element).

Nine T-138 E57 projectiles containing T-222 E4 fuze systems, a spotting charge and an extra tetryl pellet were fired through a two inch wooden bursting screen. Table VIII is a copy of the firing record. One round missed the target, four rounds functioned after passing through the bursting screen, one round functioned prematurely half-way down range, and the remaining three failed to function.

An examination of additional base element assemblies disclosed that the non-functioning and delayed functioning of these rounds may have resulted when the sliding contact failed to make contact with the base terminal as the rotor turned. It is suggested that upon impact with the bursting screen contact was established and in four of the eight rounds there was enough charge remaining to set off the T-18 detonator. A modification to the rotor stop and sliding contact assembly has been made in an effort to correct this possible cause for malfunctioning.

Finish Requirements and Reproducibility of Action of Setback Pins.

A test was carried out to study the effect of the finish of the pins and the general reproducibility of functioning of T-222 E4 base elements(DRD 260). Figure 28 shows the set-back pin apparatus used in the centrifuge for the tests. Ten sets of three pins with each of the following finishes were tested: (a) 32 micro inches, (b) 63 micro inches, (c) 85 micro inches. Table IX shows the data from the tests. In general, the variation between pins with one finish was as great as the variation between the polished and the roughest pins. The average acceleration required was 3044 G's. The pins of each given finish and group were selected randomly in the assembly process for groups I and IV and groups II and V and the functioning is quite consistent. It appears that tolerance variations are a more serious consideration than the finish and accordingly that pins made from drill rod stock or turned on a screw machine can be used without the necessity of a polishing operation.

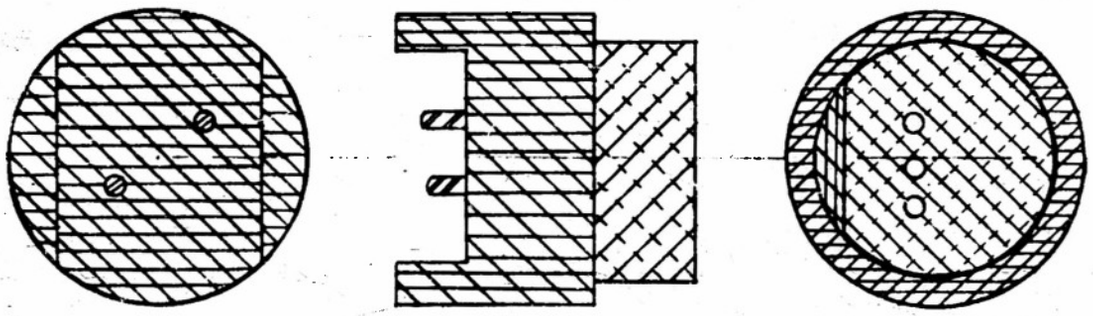


Fig. 28. Setback Pin Test Apparatus.

T-138 E57 Fuze Systems

Base Element Wiring Modification

A change in the method of establishing electrical contact between the T-208 base element and the nose element has been suggested. Figure 29 (DRC 439) shows the proposed wiring system. This design is expected to result in a greater ease of loading and in reduced chances for short circuits. Thirty of these assemblies are being made for testing. Twenty will be used in penetration tests at Erie Ordnance Depot and the remaining ten will be used in live T-138 E57 rounds fired against armor plate.

Nose Element Design Modification

In an effort to reduce the number of non-functioning T-138 HEAT rounds, the nose element and cap assembly is being redesigned. Figure 30 is a sketch of one suggested design.

Crystal Energy Studies

A program to study the effect on electrical output energy caused by changes in (a) mechanical energy, (b) angle of incidence, (c) crystal to nose cap clearance, and (d) nose cap thickness was proposed in the Sixteenth Progress Report. An apparatus for these tests is shown in Figure 17 of that report. This program is now being advanced to aid in the determination of the causes of the malfunctions in the T-138 E57 HEAT rounds. The immediate program will be to determine whether any one of the following remedial measures will be effective; inclusion of a spring washer between the crystal and the nose cap, insertion of a spring washer between the tee and the crystal to hold the crystal against the nose cap during flight.

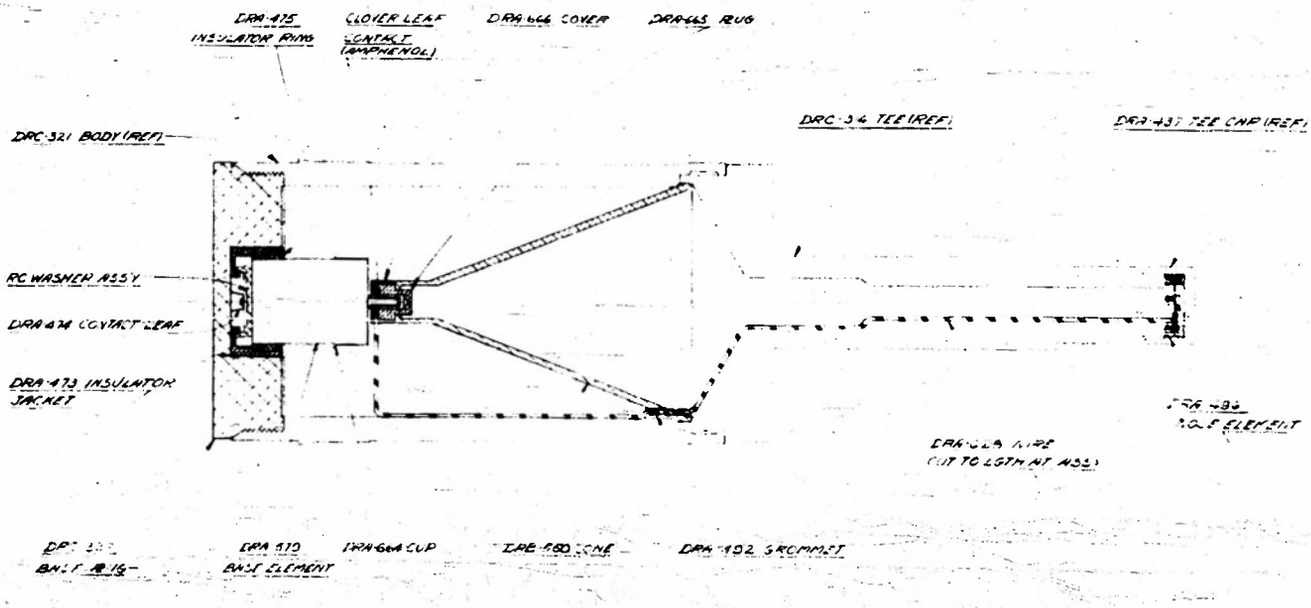


Fig. 29. Proposed Wiring System.

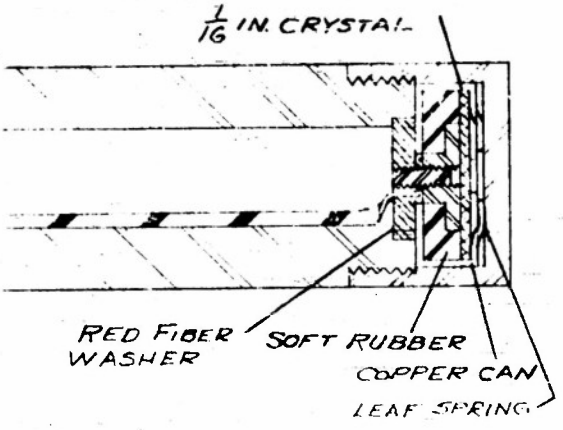


Fig. 30. Suggested Design for Nose Element and Cap Assembly.

Table VI
Firing Data, PIBD, T-267 E11 Fuze
Test of HE and WP Fuze System
Fired Into Recovery Box

Date 4-21-52 & 4-22-52 Program Supplementary II
Test of HE & WP Fuze System
Chamber 22B345E
Breech 22B345E
Tube GB 595

PROJECTILE
Model T-138
Type E57A
Weight (Nominal) 17.5 lbs.
C.G. Location 5.34 in. from base.
Bourrelet Dia. (Nom.) 4.138 −.002 in.
Special Features Fuze, PIBD, T-267 E11

TEST GUN
Model T-137 E1 No. 3
Type Prototype 105 mm.
Length of Tube 95 in.
Twist of Rifling 1-200
Sighting Equipment M-62 Elbow Telescope
Bore Dia. (Lands) 4.134 +.001 in.

MISCELLANEOUS DATA
Range Recovery Box.
Propellant PA-30239 Primer M-57
Type M10MP web .0335 Charge Wt 8 lb. 0 oz.
Proof Director Ed. Hueffman
Observers R. McCarthy, W. Brown

Round No.	Case No.	Proj. Weight (lbs)	Powder Charge lb-oz	Wind Vel. & Dir.	Chamber Pressure (piezo)	Muzzle Velocity Instr.	Muzzle Velocity Actual	Elev. (mils)	Azimuth (mils)	Position of Hit Vert.	Position of Hit Horiz.	Corrected Position of Hit – mils Vert.	Corrected Position of Hit – mils Horiz.	Bourrelet Diameter Front	Bourrelet Diameter Rear	Clearance Front	Clearance Rear	Observations
2156-1	S-17	17.50	8-0		11,070				Projectiles not magnetized – velocities not taken									
2157-2	S-22	17.50	8-0		11,340				Polyethylene liners used.									
2158-3	S-26	17.50	8-0		11,340				No pads, wads or rayon liners used.									
2159-4	D-209-8	17.50	8-0		11,600				Case and projectile loaded seperately									
2160-5	S-25	17.50	8-0		11,070													
2161-6	D-209-8	17.50	8-0		—				Results:									
2162-7	S-26	17.50	8-0		—					Eight (8) fuzes functioned.								
2163-8	S-21	17.50	8-0		—					One (1) did not function.								
2164-9	S-28	17.50	8-0		7,900(?)					One (1) assembled with M2 backwards failed to function.								
2165-10	S-11	17.50	8-0		—													
				4-21-52 Temperatures					4-22-52 Temperatures					Gage No. 105				
				Rounds Nos. 1-5					Rounds Nos. 6-10					C = .0692 μf				
				Magazine					Magazine					Cal = 25 #/in.				
				Min - 67					Min. - 69									
				Max - 70					Max. - 70									
				Present - 69					Present - 70									
				Load Room - 76					Load Room - 73									

Center of Impact ______
Probable Error – Vertical ______
Probable Error – Horizontal ______

Signed - W. Harvey

Table VII
Firing Data, PIBD, T-267 E11 Fuze
Test of HE and WP Fuze System
Fired Against Bursting Screen

Date May 9, 1962 Program _____

PROJECTILE
Model Slug
Type Band DRB-360-3
Weight (Nominal) 17.5 lbs.
C.G. Location —
Bourrelet Dia (Nom.) —
Special Features Fuze, PIBD, T-267 E11

Magazine Temperature
Min. - 70°
Max. - 70°
Present - 70°
Loading Room - 70°

TEST GUN
Model T-19, 14° breech.
Type 105 mm Recoilless
Length of Tube 85 in.
Twist of Rifling 1-200 Thin Wall
Sighting Equipment Adapted Elbow Telescope
Bore Dia. (Lands) 4.134 +.001 in.

MISCELLANEOUS DATA
Range Pendulum Mount
Propellant PA 3023-9 ; Primer M57
Type M10MP web .0285 Charge Wt. 8 lb 6 oz.
Proof Director E.R. HUFFMAN
Observers R. McCARTY

SCREEN DISTANCES
Edge 48' 7½" 62' 8"

Round No.	Case No.	Proj. Weight	Powder Charge lb oz.	Powder Depth (in.)	Chamber Pressure	Muzzle Velocity Instr.	Muzzle Velocity Actual	Elev. (mils)	Fuze Number	Position of Hit Vert.	Position of Hit Horiz.	Corrected Position of Hit – mils Vert.	Corrected Position of Hit – mils Horiz.	Bourrelet Diameter Front	Bourrelet Diameter Rear	Clearance Front	Clearance Rear	Observations
2269-1	T-6	Unknown	8-5	4	10,100	1623	1642		2	Functioned completely					Fuze set for delay			
2270-2	T-6	"	8-5	4	9,930	—	—		9	Functioned completely					Fuze set for delay			
2271-3	T-6	"	8-5	4	9,800	—	—		19	Functioned completely					Fuze set for delay			
2272-4	T-6	"	8-5	4	6,670	1653	1670		18	Functioned completely. M21 & M2 not initiated. Fuze set for superquick.								
2273-5	T-6	"	8-5	3¾	9,320	1700	1719		12	Failed due to split rotor.								
																		All fuzes recovered and returned to Akron
										Above data added after examination in fuze laboratory								

Reinforced T-6 cases used; T-6 polyethylene liners used;
Case and slug loaded separately; slugs fired into recovery box.

NOTES:
1. Bursting screen placed in front of recovery box; bursting screen constructed of 2" by 6" lumber so that slugs would penetrate 2" of lumber to assure functioning of fuzes.
2. Unable to determine whether recovered fuzes functioned as post safety regulations prohibit the disassembly of recovered rounds.
3. Water of undetermined origin found inside liner of round No. 4 prior to firing.

Center of Impact _____ _____
Probable Error – Vertical _____
Probable Error – Horizontal _____

Signed - W. Hervey

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Table VIII
Firing Data, PD T-222 E4 Fuze
T-222 E3 Nose Element, FBE-6 Base Element
Fired Against Bursting Screen

Date May 19 1952 Program Supplementary II Fuze Test

PROJECTILE
Model T-139
Type ____
Weight (Nominal) 17.10 lbs.
C.G. Location ____
Bourrelet Dia. (Nom.) ____
Special Features Fuze Program Fuze T-222 E4

Magazine Temp
Min. – 70°
Max. – 70°
Present 70°
Load. Room Temp 68°

TEST GUN
Model T-19 14° Breech
Type 105mm Recoilless
Length of Tube 85 cal.
Twist of Rifling 1-20 Thin Wall
Sighting Equipment Adapted Elbow Telescope
Bore Dia. (Lands) 4.134 +.001 in.

MISCELLANEOUS DATA
Range 150 yds Bursting Screen
Propellant PA 30239 Primer M57
Type M10MP web .0335 Charge Wt. 8 lbs 5 oz.
Proof Director Ed. Huffman
Observers W. Russel, W. Brown

Round No.	Case No.	Proj. Weight	Powder Charge lb-oz	Wind Vel. & Dir.	Chamber Pressure (Copper)	Muzzle Velocity Instr.	Muzzle Velocity Actual	Elev. (mils)	Azimuth (mils)	Position of Hit Vert.	Position of Hit Horiz.	Corrected Position of Hit – mils Vert.	Corrected Position of Hit – mils Horiz.	Bourrelet Diameter Front	Bourrelet Diameter Rear	Clearance Front	Clearance Rear	Observations
2275-1	T-6		8-5		10,280			Missed target – sighting point too high										
2276-2	T-6		8-5		9,960			Functioned approximately 25 yards beyond bursting screen										
2277-3	T-6		8-5		10,180			Passed through screen without functioning.										
2278-4*	T-6		8-5		10,340			Functioned prematurely with tracer-like action halfway down range										
2279-5	T-6		8-5		10,166			Functioned approximately 25 yards beyond bursting screen										
2280-6	T-6		8-5		10,460			Passed through screen without functioning.										
2281-7	T-6		8-5		10,170			"	"	"	"	"	"					
2282-8	T-6		8-5		10,400			Functioned approximately 25 yards beyond bursting screen.										
2283-9	T-6		8-5		9,955			"	"	"	"	"	"	"	"	"	"	

T-6 cases and polyethylene liners used.
No wads, pads or rayon liners used.
Case and projectile loaded seperately
Muzzle velocities not taken

*Note: Tracer-like action of Round 4 suggests break in base plate of projectile. Flight of projectile did not appear to be erratic.

Center of Impact ____
Probable Error – Vertical ____
Probable Error – Horizontal ____

Signed – W. Herrey

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Table IX
Setback Pin Tests

Trial	Centrifuge Meter Reading	Acceleration G's
Group I 32 μ in. finish, pins tested as received.		
1	26	3100
2	21	2000
3	27	3300
4	20	1900
5	31	4300*
*No. 2 pin was oversize. After reworking assembly was retested.		
5	23	2500
6	21	2000
7	30	4000
8	22	2300
9	27	3300
10	20	1900
Avg.	23.7	2630
Group II 63 μ in. finish, pins tested as received.		
1	25	2900
2	28	3500
3	37	6300
4	30	4000
5	30	4000
6	24	2700
7	Failed to function *	
7	" " " *	
*No. 3 pin oversize. After reworking assembly was retested.		
7	25	2900
8	30	4000
9	30	4000
10	30	4000
Avg.	28.9	3830

Table IX (Cont.)

Trial	Centrifuge Meter Reading	Acceleration G's
Group III 85 μ in. finish, pins tested as received.		
1	24	2700
2	22	2300
3	26	3100
4	27	3300
5	21	2000
6	30	4000
7	23	2500
8	30	4000
9	22	2300
10	22	2300
Avg.	24.7	2850
Group IV 32 μ in. finish, burrs removed before testing.		
1	20	1900
2	20	1900
3	19	1800
4	27	3300
5	26	3100
6	23	2500
7	20	1900
8	26	3100
9	19	1800
10	19	1800
Avg.	21.9	2310
Group V 63 μ in. finish, burrs removed before testing.		
1	37	6300
2	28	3500
3	27	3300
4	26	3100
5	33	4900
6	20	1900
7	29	3700
8	21	2000
9	27	3300
10	30	4000
Avg.	27.8	3600

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